The Just-in-Time Production Challenge

Here's a proven method to put your company ahead of the competition.

By W. CHRISTOPHER MUSSELWHITE

American industrial managers have discovered that Japanese industrial success depends not on miracles. In fact, many of the best Japanese management and production techniques originated with—but, ironically, were abandoned by—American corporations.

One such technique now rediscovered by some of America's largest corporations is just-in-time production (JIT), which the Japanese attribute to Henry Ford. Ford, GM, and Chrysler have implemented JIT in some production lines. Electronics firms such as Westinghouse, General Dynamics, Hewlett-Packard, and Apple have made major commitments to JIT production. Even textile companies such as Burlington are rearranging traditional production operations to incorporate the techniques that have been so successful in Japan.

Looking to the East

To learn from that success, Westinghouse Electric Corp., from 1979 to 1982, sent to Japan 275 managers and union representatives. The study team found the following:

- Most of the stories about Japan's famed productivity are true.
- The productivity gains were not achieved with magic. In neither product nor process technology is there anything that is not also available in the U.S.
- Business is conducted, however, in a manner substantially different from the U.S. style. There is a remarkable spirit of cooperation and dedication in the workplace. Workers' skills are upgraded through training on company time—and at company expense.

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In the early 1980s, Ford Motor Company began sending batteries of people to Japan to study its techniques. Wade Deal, JIT manufacturing coordinator for Ford, described the early consequences of this search process: "Depending on which discipline you were from, you came back with a different perception of what they were doing in Japan." The industrial relations group that went to Japan started an employee involvement process. The quality control people thought statistical quality control was the secret. Manufacturing and plant engineers attributed Japan's success to a productivity program including automation, robots, and plant design. Purchasing people thought it was the way the Japanese worked with suppliers. Finally, the materials-handling people thought the answer was to rid themselves of inventory.

Deal decided that no one was right individually, but collectively they were all right. The searchers had each discovered a component of an entire JIT production system. Deal concluded that "what was really needed was an education and awareness program to bring out the benefits of each of those and make people aware of how they fit together."

Several North American companies have used this system approach to implement JIT production. John Smith, president of GM-Canada, conservatively estimates savings of $235 million over four years. In July 1984 Northern Telecom Inc.'s Data Systems Division began a single pilot JIT production program. The

Musselwhite is a professor in the school of technology at North Carolina A&T State University, Greensboro.

pilot was so successful that all of the company's 50-odd manufacturing plants are being converted. Hewlett-Packard totally has converted three divisions to JIT and more than half the HP divisions partially have implemented JIT. IBM Corp. made JIT an official part of corporate strategy in 1984 and is now running an internal education program to inform employees of JIT's potential. Even with this commitment by major U.S. corporations, it has been estimated that less than 10 percent of U.S. industrial production currently uses the JIT production system.[1]

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Understanding JIT

The principles underlying JIT are total quality control (TQC) and kanban. TQC commits management to achieve zero defects; kanban, a technique perfected by Toyota, involves producing and buying parts in very small quantities "just in time" for use. Advantages include reducing stored and in-process inventory, through time, and storage space.

JIT production compares to a rocky river bed. The slowly flowing river is analogous to the flow of material through the production process, the river's water level to the level of inventory in the production process, and the rocks and boulders in the river bed to problems inherent in new or unimproved production processes. These obstacles can cause heavy currents and stagnant pools to exist. If the water level is lowered slowly and systematically, the largest boulders appear and then can be removed from the stream. As this process of lowering the water level—or inventory—continues, more obstacles to a smooth flow are exposed and then removed. By lowering the inventory once used to hide production problems, production problems can be identified and remedied. The river—or production process—begins to flow more swiftly and smoothly.

JIT production relies on a *pull* rather than *push* production philosophy. The push system, a method prevalent in the U.S. and Western Europe, means moving material through a production line with the support of traditional industrial engineering techniques. Each individual in the process must produce at maximum capacity in their particular operation without regard to the status of operations upstream. If a problem develops upstream, then considerable buildup of in-process inventory can occur at the problem site.

The pull system works in the opposite direction. An operator passes along in-process inventory only when a signal—a kanban—is received from the next operator in the production process. The pull system can be used throughout the production enterprise, beginning with raw material processing and ending with the shipment of finished products. For example, an electronics firm assembling testing equipment can use JIT on the assembly line, thus having minimal in-process inventory. The assembler who installs a printed circuit board can pass the partially assembled tester to the next assembly operation only when the next assembler signals that he or she is ready. This prevents each assembler from stockpiling partially completed testers.

By expanding the application of JIT, stockpiling unassembled printed circuit boards and other components at assembly work stations can be eliminated. Each assembler would have to signal through a kanban when they needed more components. Preventing warehouse inventory buildup requires a plant delivery strategy using the JIT production system. This demands a totally new relationship, one which has been developed in Japan primarily among the larger industrial concerns.

Implementation principles

A JIT production system cannot be implemented overnight and should not be seen as a quick fix for productivity or quality problems. Successful implementation requires careful, long-range planning and support from management levels high enough to champion system-wide organizational change—and to weather the perils of such change. Many JIT benefits are long term, but American managers restrict themselves to short-term profit expectations, a philosophy that breeds fear of risk taking.

Viewed narrowly, JIT appears as an inventory management system. In reality, however, JIT manages the entire production process. Successful JIT production includes the following characteristics:

- *Plant-wide quality control.* Everyone in the plant must be included, and quality control must be an ongoing process. Merely inspecting the finished products is not adequate. Production people become responsible for quality.
- *Exposure and examination of every defect.* The defective part must be attended to even at the expense of stopping the production line, an action unthinkable in the U.S. After adequate training, each production worker receives the authority to stop the production line when a serious problem develops.
- *Worker responsibility for repair.* This gives each worker greater interest in the adjustment and setup of the production equipment. Because defective parts are no longer sent to a different department for repair, workers must receive adequate training.
- *Production worker responsibility for equipment maintenance.* Again, adequate training is called for.
- *A production environment that focuses on one product line or a similar group of products with 300 or fewer employees.* This can reduce setup times, foster a sense of belonging, and encourage better management.
- *Group technology facilitating JIT production.* Group technology is described as "the arrangement of equipment of different types in one area to facilitate the existing manufacturing process."[2] And successful group technology implementation requires cross-training production workers.
- *An order quantity of one unit or one container.* This is in keeping with the JIT concept of supplying the exact quantity needed and no more. For a production line that produces a family of products, the equipment may have to be set up differently for each item. If an order quantity of one is to be approached, then setup times must be reduced drastically. Many examples of such reductions are available.

Culture's role in transference

The above notwithstanding, the application of Japanese manufacturing techniques in the U.S. cannot be discussed without acknowledging cultural differences. Often, each culture appears out of phase with the another.

When admiring Japanese businesses for their commitment to human resource development (lifelong employment for example), certain facts should not be ig-

nored. Japan's industrial miracle has been limited to larger companies that employ about 30 percent of Japanese workers. In many cases, the commitment to lifelong employment is achieved through the buffer of part-time employees who receive few, if any, benefits. Women often are denied lifelong employment and may be expected to relinquish their jobs when they marry. When mandatory retirement age is reached at 55, many Japanese will go to work for primary suppliers on a part-time basis to supplement fixed retirement incomes. Subcontractors, to be competitive, cannot afford to emphasize the people they employ as a valuable and respected resource. Relations build over time between suppliers and large companies on the basis of low cost as well as trust in their ability to supply.

The management theorists discount U.S. cultural differences as an impediment to performance. Tom Peters sees performance as a management problem. According to Peters, in the U.S. the ratio of managers to workers is 1 to 10 while in Japan it is 1 to 200. The U.S. focus is on managers; in Japan it is on people.

But Thomas J. Nivens, head of a Toyota-based consulting firm, says that U.S. managers are "defensive about adopting an idea from someone below them, or passing it on to someone higher." When an employee in Japan makes a suggestion that is not used, Nivens observes, management must provide a full, face-to-face explanation to the employee. What's more, new managers are advised never to say no to a young employee. "That's good thinking," is the standard negative response.

These cultural differences as well as variations in politics, economy, and geography make a complete copy of the Japanese JIT production system infeasible in the U.S. However, some aspects of JIT production can be applied. For example, in his book *Japanese Manufacturing Techniques: Nine Hidden Lessons in Simplicity*, R.J. Schonberger writes that "management technology is a highly transportable commodity." He concludes that the Japanese have had little trouble learning our techniques, and we will have little trouble learning theirs.

A testimony to the transferability of Japanese manufacturing techniques to the U.S. can be found in Smyrna, Tennessee. The Nissan Motor Manufacturing Corp. U.S.A., which uses JIT production techniques, has set phenomenal records. The March 1985 issue of *Modern Materials Handling* reports that after a year and a half Symrna's productivity was equal to that of the parent company in Japan, and after two years productivity is forecast to surpass the parent company.

America must learn from abroad

Lessons from successful use of JIT production derive not only from Japan's Nissan and Toyota but also from Sweden's Volvo. Volvo's efforts at innovation in the workplace have ranged from quality circles and participative management to motivational models. Jonsson and Lank say that "the aim was never to try to influence moral or ideological values, but rather to create a work environment that provides social reward."[3] They describe the Volvo plant supervisor's role as that of setting examples and creating identification with management. In many ways Volvo's efforts and JIT resemble each other. Core aspects of the Volvo work environment include skill, variation, task identity, task significance, autonomy, and feedback on the results of each job.

Today American industry must recognize the challenge from abroad and restructure and compress traditional management levels. Management thinking must evolve to include production workers in planning, deciding, implementing, and evaluating. Human resources in the U.S. will remain underutilized until corporate strategies include teaching basic job skills, cross-training for multiple purposes, and the encouragement of decision making and problem solving from every member of the production team.

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